

**AFRL-ML-WP-TR-2001-4065**

**TECHNICAL OPERATIONS SUPPORT  
(TOPS)**

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**OCTOBER 2000**

**FINAL REPORT FOR PERIOD OF 16 AUGUST 1994 – 23 AUGUST 1999**

**Approved for public release; distribution unlimited**

**MATERIALS AND MANUFACTURING DIRECTORATE  
AIR FORCE RESEARCH LABORATORY  
AIR FORCE MATERIEL COMMAND  
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433-7750**



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<b>13. ABSTRACT (Maximum 200 Words)</b>  The Technical Operations Support (TOPS) program was established to assess existing and future Air Force systems requirements and identify materials and processes needs to met these requirements. TOPS was implemented to develop draft research and development plans to meet these requirements, to develop and implement strategies to promote adoption of Materials and Manufacturing Technology Directorate technology on Air Force systems, and to transfer this knowledge to the public sector. To facilitate the TOPS program and management process, all efforts were categorized into one of six categories: analysis, assessments, technical consultations, technology transition and transfer, strategic studies, and workshops.				
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## **1.0 Program Description**

The Air Force Research Laboratory Materials and Manufacturing Directorate (AFRL/ML) is charged with the responsibility for planning and executing the United States Air Force (USAF) exploratory development and research programs, as well as system support for materials and processes. As in-house and contracted programs formulate new approaches and techniques resulting in advances in materials research, these innovations must be reviewed occasionally from a non-Materials Directorate perspective to insure quality and timely solutions to current aerospace and materials problems.

The TOPS Program was established to assess existing and future Air Force systems requirements and identify materials and processes needs to meet these requirements. TOPS was implemented to develop draft research and development plans to meet these requirements, to develop and implement strategies to promote adoption of Materials Laboratory technology on Air Force systems, and to transfer this knowledge to the public sector. To facilitate the TOPS program and management process, all efforts were categorized into one of six categories: analysis, assessments, technical consultations, technology transition and transfer, strategic studies, and workshops.

The Technical Operations Support (TOPS) Program was tasked with acquiring short-term research and development (R&D) and system support efforts not readily available either in-house or under existing contracts, to support AFRL/ML and USAF. Additionally, the program selected appropriate external sources to analyze, assess and consult on appropriate materials and process support.

## **2.0 Primary Objectives**

The primary objective of this contract was to provide short-term external analyses, assessments, lectures and workshops, technology transition/transfer activities, strategic studies, and experts/consultants to assist in conduct of technical/strategic planning and of in-house assessments and analysis. This program was intended to support the AFRL/ML in research, exploratory, and advanced development, as well as in systems support. It was intended to provide Air Force program managers with expert technical input and increased flexibility in the direction of the Directorate's technical program, requirements, and advancements. The contract was intended to provide capabilities for acquiring research, development, and systems support not readily available in-house or under existing contracts.

### 3.0 Executive Summary

Universal Technology Corporation (UTC) has fulfilled the objective of the Technical Operations Support (TOPS) Program by providing external assistance in technical/strategic planning, and support of in-house assessments and analyses. The TOPS contract used the task order process to execute rapid start-up of tasks to provide expert UTC and subcontractor assistance. During the 60 month period (16 August 1994 – 23 August 1999) UTC and subcontractors conducted and successfully completed 304 tasks. The experiences gained under this contract include conferences/meetings, technology transfer, information dissemination, strategic planning, assessments and management support. This contract provided the AFRL/ML quick turnaround for executing all efforts listed below.

All efforts were categorized into one of six categories: analysis, assessments, technical consultations, technology transition and transfer, strategic studies, and workshops, recognizing that the nature of certain individual tasks will overlap into more than one category.

Under the TOPS Program in the area of analysis and assessments, UTC provided technical support for the Advanced Weapons Technologies Volume of the DoD Military Critical Technologies List (MCTL). This effort included attending working group meetings in Washington D.C., and writing and editing major sections of the document. UTC supported the Research and Development Volume of the MCTL. UTC has supported the Operational Requirements Technology Investment Plan produced by WL/XPR and provided database support, data collection, data compilation, and creation and editing of this document. UTC has supported the DoD Project RELIANCE activities including the Materials and Processes Defense Technology Objective (DTO) documents and the Technology Area Review and Assessment (TARA) meetings. UTC participated as a member of the Pollution Prevention Group of AFRL/ML. Efforts under this task include reviewing R&D contracts for hazardous materials, reviewing the C-17 pollution prevention program plan, serving on the AFR/ML Paint Team, attending meetings/conferences, and working with SPOs on pollution prevention projects. UTC supported the AFRL Coatings Technology Integration Office with technical, programmatic, business management and operations assistance. UTC assisted in the preparation of numerous high level briefings, reports, and strategy papers in support of the AFRL Aging Aircraft Office. UTC managed numerous technical analyses performed by industry, universities, and independent technical experts.

In the areas of technical consultations, UTC has managed theoretical research to support the reduction of defects in Periodic Group II-VI Materials. This effort contributed to the AFRL/MLPO program on defect reduction in long-wave infrared (LWIR) mercury cadmium telluride (MCT) materials. UTC managed efforts using Dynamic Magnetic Consolidation (DMC) methods to consolidate Samarium Cobalt powders to near full density and thus subject them to minimum/no sintering. This study helped illuminate DMC's use as a compaction technique for samarium cobalt permanent magnet materials.

In the areas of technology transition and transfer, UTC provided technical and management support for Cooperative Research and Development Agreements (CRDA's) for ML since the start of the contract. UTC managed approximately 75 conferences, reviews, workshops, and meetings since the inception of the contract. The UTC Meeting Management Division has managed each of the Combined Materials and Manufacturing Technology Roadmap Reviews, the Aging Aircraft Conferences, and the USAF Aircraft Structural Integrity Program (ASIP) Conferences for the past twelve years, the last 5 years being on supported by TOPS. Other Conferences included the 1995 and 1996 Air Force Corrosion Program Manager's Conferences, WL/XP's Modern Millennium Conference, the Tri-Service Titanium Review, the HAVE Forum, and the 1996 and 1997 NDI Conferences. Additionally, UTC managed the 1998 and 1999 Materials and Manufacturing Technology Series, and the 1999 International Committee on Aeronautical Fatigue (ICAF 1999) meeting all under TOPS. UTC prepared brochures, pamphlets, handouts, and displays in support of various meetings and technology transfer efforts. UTC prepared numerous technical and advocacy briefings and papers in support of Government meetings and projects.

In the area of strategic planning, UTC participated in workshops to review and critique AFRL/ML's strategic planing process and direction while providing assessments and recommendations of the programs, strategies, activities, and resources. UTC helped to develop improved methods and conduct comparative analyses of in-house facilities and programs relative to ML needs. These efforts helped to address decreased in-house R&D activity, and emphasize contract programs and needs for expanding ML involvement in technology transition and transfer.



## **4.0 Funding**

The TOPS Program was awarded on 16 August 1994 for a contract value of \$7,768,959. On 28 September 1995, P00027 established a Contract Line Item Number (CLIN) 0004, and Contract Assistance and Advisory Services (CAAS). On 1 March 1996, P00037 established CLIN 0005 (3400 nonCAAS), CLIN 0006(3400 CAAS), and the contract ceiling increased from \$7,768,959 to \$10,968,959. On 9 July 1998, P00065, increased the contract ceiling from \$10,968,959 to \$15,002,143. On 22 August 2000, P00086 established the final total funding on the contract at \$11,965,816.

## 5.0 Task Order Summary

### UTC TOPS Contract

F33615-94-C-5800

Task Order	Type of Work	Product AF Received
TO 001, 020, 026	Administration of the contract including drafting subcontract agreements, tracking expenditures, modifying agreements, monthly reporting	Monthly reports to AF Project Engineer, periodic detailed financial tracking of subtask expenses
TO 002*, 021**, 030	Meetings management, brochure design, CRDA development, workshop leadership	Successful management of large meetings, SBIR brochures, workshops
TO 003	Technical Assessment	Assessment of Russian progress in aircraft metals development
TO 004	Technical design	Quantitative evaluation and design of die tooling systems
TO 005	Literature and Industry Survey	Report of current industry practice on stress relief of Ti alloys
TO 006	Assessment of material substitutes for environmentally bad materials	ASC HazMat Guide and supporting web site
TO 007	Material testing	Report on bending and compression tests under hot/wet conditions of radome material from an in-flight failure
TO 008	Determination of materials properties	Report on effect of heat treatment on properties of TiAlNb alloy
TO 009, 018	Experimental and theoretical analyses on advanced materials	Analysis reports on deicing fluids and failed materials
TO 010*, 019**, 029**	Technical program assessments	Reports on ML technical programs/areas of interest, and technical area support
TO 011*	Management of technical workshops and conferences	Professionally run workshops and conferences
TO 012, 022	Quick response expert consultation, analysis, advice, and assessments	Reports providing technical advice and consultation in areas of interest to ML
TO 014	Technical advice and consultation	One-day seminar at ML by a technical expert
TO 015	Technical assessment of material application	On-going assessment of ceramic matrix composite applications in low observables
TO 016, 025**, 027**	Strategic planning support to ML leadership	Report on suggested strategies for Materials Directorate. Draft ML Strategic Plan presented to ML Executive Group
TO 017	Experimental study	Report and samples of a new moisture resistant aircraft fuel tank sealant
TO 024**	Operational and maintenance mission support, system support (3400 funds)	Conversion of govt specs and standards to non-govt specs and standards, assistance with field supportability materials problems

Notes: \* = Changed from non-CAAS to CAAS after award of TO

\*\* = TO awarded as CAAS

## **6.0 One-Page Task Order Summaries**

**TASK ORDER 001– Program Management**

**START:** 16 Aug 94

**END:** 15 Oct 95

**FUNDING:** \$109,146

**EXPENDITURES:** \$103,458

**NUMBER OF SUBTASKS:** 1

**OBJECTIVE:** To provide for those program activities necessary to establish task orders and conduct program management and administration over the entire program.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order supported the UTC program management and administrative costs for the entire contract throughout the period.

**TASK ORDER 002– ML Technology Transition and Transfer**

**START:** 16 Aug 94

**END:** 15 Dec 95

**FUNDING:** \$215,450

**EXPENDITURES:** \$212,877

**NUMBER OF SUBTASKS:** 10

**OBJECTIVE:** To provide a vehicle for ML developed technologies to be recognized, accepted and transitioned to DoD contractors and transferred to the commercial sector.

**LARGEST SUBTASKS:**

- a. 002-03 Technology Transition and Transfer (CRDA) Support – UTC, \$80,987
- b. 002-04 Advanced Processing (Casting) Support – UTC, \$34,013
- c. 002-07 Compressor Research Facility Data Acquisition and Presentation Aids – UTC, \$33,898
- d. 002-06 1995 WL Product Technology Plan & HQAFMC/ST Data Call – UTC, \$23,027

**SUMMARY:** This task order supported the transition of a variety of technologies to the next higher stage of development. The Task 02-3 effort developed Cooperative Research and Development Agreements (CRADA) with local industries as substitutes for the more expensive Test Agreements for many of the ML-owned experimental facilities. The Task 02-4 effort developed a roadmap for the F119 TiAl cover plate to transition it through 6.2, 6.3, NDI, ENSIP, Producibility, and Qualification Testing stages. Task 02-7 acquired the capability for the Compressor Research Facility to accomplish visual data acquisition, recording and projection to aid in transition of gas turbine engine fan and compressor materials. The Task 02-6 effort correlated WL developed technologies to Air Force operational deficiencies.

**TASK ORDER 003– Russian Materials Assessment Team (RMAT)**

**START:** 15 Sep 94

**END:** 14 Sep 95

**FUNDING:** \$24,962

**EXPENDITURES:** \$24,464

**NUMBER OF SUBTASKS:** None

**OBJECTIVE:** To support the Russian Bilateral Airworthiness Agreement in its assessment of the Russian system for the production and continued quality control of metallic materials used in aviation products as they move from the origin to the final product.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by Mr. Clay Harmsworth. Mr. Harmsworth served as one of the five members of the U.S. bilateral certification team. The team made two trips to Russia to examine all aspects of the Russian aircraft materials certification process for metals development, testing, production and application to design. Numerous differences in the metals certification process were cited in the final report dated 20 August 1995.

**TASK ORDER 004-- Forge Tool Design**

**START:** 30 Sep 94

**END:** 31 Mar 95

**FUNDING:** \$7,935

**EXPENDITURES:** \$7,755

**NUMBER OF SUBTASKS:** None

**OBJECTIVE:** To evaluate and recommend forge tool design configurations for making subscale TiAl engine components under isothermal and near isothermal conditions.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by Mr. Charles Gure, an independent contractor to UTC. Mr. Gure evaluated various shapes to be incorporated in forging tools for the deformation of engine components in selected alloys, along with other process parameters. He evaluated quantitatively the affects of corner, fillet and taper shape changes machined in the tool impression for strain concentration factors. He provided technical assistance in the design of closed-die and open-die tooling systems for producing subscale turbine disk components on the AF 1000 ton press.

**TASK ORDER 005— Materials Joining for Aerospace Applications**

**START:** 27 Jan 95

**END:** 31 Mar 97

**FUNDING:** \$100,252

**EXPENDITURES:** \$61,998

**NUMBER OF SUBTASKS:** None

**OBJECTIVE:** To characterize state-of-the-art localized stress relief techniques for structural titanium alloys.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by Edison Welding Institute (EWI) as subcontractor to UTC. EWI conducted a literature survey of the different stress relief techniques in current use and also conducted an industry survey of the current practice in 10 aerospace companies and at OC-ALC. Although the literature review revealed little information on current industry practice, EWI documented information from the industry survey in their report dated October 22, 1996.



**TASK ORDER 006-- Assessment to Identify Alternative Materials and Substances to Prevent Pollution**

**START:** 27 Jan 95

**END:** 31 Aug 96

**FUNDING:** \$135,000

**EXPENDITURES:** \$129,936

**NUMBER OF SUBTASKS:** None

**OBJECTIVE:** To identify materials and substances most likely to qualify as substitutes or alternatives to specified substances and materials that are required for use on Air Force weapon systems and are listed (or controlled) by the USEPA and other mandates. To update and expand the ASC HAZMAT Alternatives Guide.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by Chuck Alford of UTC. Mr. Alford orchestrated the development of the ASC HazMat Guide and developed the Guide so it would reside on the ASC/EM World Wide Web Site.

**TASK ORDER 007– Assessment of Radant Nose Radome Test Specimens**

**START:** 18 Nov 94

**END:** 17 Mar 95

**FUNDING:** \$15,978

**EXPENDITURES:** \$15,666

**NUMBER OF SUBTASKS:** None

**OBJECTIVE:** To perform an assessment of 40 Radant Nose Radome test specimens from existing material stock

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by UDRI under subcontract to UTC. This task arose out of an in-flight failure of a Combat Talon II nose radome produced by Radant Technologies. UDRI conducted conducted bending and compression tests on a total of 40 samples under both dry and hot/wet conditions. They concluded that the radome material exhibited serious reduction in strength and modulus when subjected to 260 degree F wet testing. Results are detailed in the UDRI final report UDR-TR-95-26 dated March 1995.

**TASK ORDER 008-- Metallic Composites II**

**START:** 17 Oct 94

**END:** 30 Dec 94

**FUNDING:** \$7,200

**EXPENDITURES:** \$7,049

**NUMBER OF SUBTASKS:** None

**OBJECTIVE:** To determine interface properties and deformation characteristics in advanced metallic composites for high temperature applications.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by Mr. Michael Foster under subcontract to UTC. The purpose of the study was to study the effect of heat treatment on the tensile and creep properties of Ti-22Al-23Nb alloy, a candidate alloy for advanced gas turbine applications. The study indicated that the heat treatment did not improve the tensile properties of the alloy above the as-fabricated condition, but it did markedly improve the isothermal creep performance. The report was to be published in *Scripta Met.* Journal.

**TASK ORDER 009 – Technical Analyses**

**START:** 15 Feb 95

**END:** 31 May 96

**FUNDING:** \$270,000

**EXPENDITURES:** \$261,993

**NUMBER OF SUBTASKS:** 7

**OBJECTIVE:** To provide both experimental and theoretical technical analyses of current materials and processes to develop and support all AF systems.

**LARGEST SUBTASKS:**

- a. 009-03 Environmental Compatibility Study of Deicing/Anti-Icing Fluids – UPenn, \$128,273
- b. 009-06 Mechanical Property Evaluation of CT-II Radome – UDRI, \$72,400
- c. 009-04 Structural Failure Analysis – UTC, \$39,955

**SUMMARY:** This task order was the first of two providing experimental and theoretical analyses for materials of interest to ML. Major accomplishments under Task Order 009 included achieving the highest structural quality AlN and GaN single crystals on sapphire substrates ever reported, and a study of environmental compatibility of a new NASA deicing/anti-icing fluid. Biochemical Oxygen Demand (BOD) tests were performed on the NASA fluid and other fluids in the inventory. Although BOD was a problem with all fluids in both a surface and a ground water environment, the new NASA fluid was most easily degraded under both anoxic and anerobic conditions. The radome mechanical property evaluation (TO 0009-6) was completed under the follow-on Technical Analyses task 018.

**TASK ORDER 010 – Assessments**

**START:** 3 Jan 95

**END:** 2 Jan 96

**FUNDING:** \$315,340

**EXPENDITURES:** \$321,028

**NUMBER OF SUBTASKS:** 10

**OBJECTIVE:** To assessments of on-going and projected technical programs and technology areas, to assist the guiding of ML investment strategy policy, and to study policy for current and projected AF weapons systems.

**LARGEST SUBTASKS:**

- a. 010-05 Assessment of Advanced Materials & Technologies for IHPTET Applications – UTC, \$121,359
- b. 010-03 Airframe & Propulsion Structural Materials Program Assessment – UTC, \$56,586
- c. 010-06 Technical Assessment of System Payoff for Future IHPTET Turbine Engine Materials and Related Technologies – Fredette et al, \$52,165
- d. 010-07 Analysis of High Speed Propulsion Systems – UTC, \$27,526

**SUMMARY:** This task order was the first of three on this contract to support technical assessments of ML programs. It supported primarily technical program assessments related to the Integrated High Performance Turbine Engine Technology (IHPTET) program, and the development of alternate strategies and options for their implementation. The task also supported preparation for the Propulsion & Energetics Panel (PEP) of the AGARD Aerospace 2020 Study, and a Global Strike Aircraft Mission Analysis.

**TASK ORDER 011 – Lectures, Workshops and Seminars**

**START:** 3 Jan 95

**END:** 2 Jan 96

**FUNDING:** \$319,991

**EXPENDITURES:** \$312,741

**NUMBER OF SUBTASKS:** 27

**OBJECTIVE:** To bring together experts in the field to provide technical input to the Technology Thrust Integrated Product Teams (TTIPTs) to enable these teams to make technical decisions that best serve the Air Force.

**LARGEST SUBTASKS:**

- a. 011-17 Solvent Substitution Workshop– Weapons Complex Monitor Forums, \$92,635
- b. 011-19 Scramjet Combustor Workshop – Eight Subcontractors, \$52,997
- c. 011-15 1995 ASIP Conference – UTC, \$38,292
- d. 011-13 1995 Combined ML/MT Roadmap Review – UTC, \$33,996
- e. 011-21 1995 AGARD Panel Meeting – UTC, \$26,829

**SUMMARY:** This task order supported primarily a wide variety of short seminars/workshops where a technical expert was brought in to ML or a nearby location to provide the seminar/workshop. Seminars/workshops provided included MBE Growth & Characterization, Ab Initio Rate Calculations for Hydrogen Abstraction Reactions, Modeling of Dynamics of Chemical Reactions involving Multidimensional Tunneling, Morphology of Liquid Crystalline Polymers, Conductive Polymers, Effects of Aging on Organic Matrix Composites, and Recent Advances in Coatings Systems. The larger workshops listed in the previous section included meetings management and often multiple speakers.

**TASK ORDER 012 – Technical Consultations**

**START:** 15 Feb 95

**END:** 31 May 96

**FUNDING:** \$203,000

**EXPENDITURES:** \$199,179

**NUMBER OF SUBTASKS:** 7

**OBJECTIVE:** To provide state of the art advice and consultation in support of Air Force technology and to provide quick response access to experts for short term analyses and assessments in the execution of technology initiatives and programs.

**LARGEST SUBTASKS:**

- a. 012-05 Pollution Prevention– Kolek, \$68,469
- b. 012-03 High Speed Airbreathing Propulsion Systems – Carriero/Leingang, \$61,000
- c. 012-01 Breakdown of Lamellar Microstructure in Ti Alloys – Wright State, \$48,889
- d. 012-04 Temperature Stability of Magnets – Crucible Research, \$22,994

**SUMMARY:** This task order was the first of two on this contract to support technical consultations on technology of ML interest. It supported primarily technical consultations in those four subtasks listed above. Under TO 012-05, Mr. Kolek provided consultation support for alternative environmentally compatible materials and processes to replace those that use or generate toxic substances. Under TO 012-03, Mssr. Carriero and Leingang conducted a propulsion/airframe integration assessment of high speed airbreathing propulsion systems of use as a standoff hypersonic weapon. Task order 012-01 developed stress-strain curves showing the effect of sequential hot deformation on the breakdown of lamellar microstructure in two-phase Ti alloys. Under TO 012-04, 2:17 magnets were prepared and tested at various temperatures. Temperature coefficients, coercivity and Curie temperatures were compared and reported.

**TASK ORDER 014 – Laser Processing of SiC**

**START:** 17 Nov 94

**END:** 30 Dec 94

**FUNDING:** \$1,773

**EXPENDITURES:** \$1,157

**NUMBER OF SUBTASKS:** 1

**OBJECTIVE:** To provide state of the art advice and consultation on the uses of pulsed laser processing of SiC. This consultation shall include a seminar and round table discussion with ML personnel.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order supported by Professor Tom Sigmon of Arizona State University, under subcontract to UTC. Professor Sigmon provided advice and consultation during a one-day seminar at ML regarding techniques Arizona State is pursuing which can be used for selective doping of SiC without subjecting the substrate to high temperature processing or requiring the growth of epitaxial layer.



**TASK ORDER 015 – Ceramic Matrix Composites (CMC) in Low Observable Assessment**

**START:** 1 Feb 95

**END:** 31 Jan 96

**FUNDING:** \$36,651

**EXPENDITURES:** \$36,515

**NUMBER OF SUBTASKS:** 1

**OBJECTIVE:** To conduct an assessment of the applications of ceramic and ceramic matrix composites in low observables.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by Dr. Robert Ruh, under subcontract to UTC. Dr. Ruh assessed and verified performance and properties of promising ceramic composite material candidates for low observable applications, and recommended appropriate technology development programs.

**TASK ORDER 016 – Strategic Planning**

**START:** 1 Feb 95

**END:** 30 Apr 96

**FUNDING:** \$60,000

**EXPENDITURES:** \$75,370

**NUMBER OF SUBTASKS:** 1

**OBJECTIVE:** To assess DoD, industry and academia materials R&D programs and identify technology areas requiring increased Materials Directorate emphasis, in planning for strengthening ML's continuing leadership role in materials R&D programs..

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order was supported by Mr. Warren Johnson of UTC. Mr. Johnson orchestrated a comparative analysis of in-house facilities and programs with contractual progress within ML, relative to identified customer needs and ML strategic plans. The information served as a baseline upon which ML could consider strategies for the direction of the Materials Directorate. The effort involved gathering internal ML interview data and using a senior panel of experts to integrate this data with external environmental factors. Based on the analysis, a ML strategic plan was developed and refined by the senior panel for presentation to the ML Executive Group.

**TASK ORDER 017** – Analyze and Conduct Technology Transition of Light Curing Sealant

**START:** 12 Apr 95

**END:** 31 May 96

**FUNDING:** \$49,425

**EXPENDITURES:** \$43,288

**NUMBER OF SUBTASKS:** 1

**OBJECTIVE:** To perfect and transition a new light curing fuel tank sealant from research to the ALCs and USAF bases.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order supported by Sunrez Corporation, under subcontract to UTC. In a previous program, Sunrez developed a light cured polysulfide sealant for field repair of aircraft fuel tanks. In this program, Sunrez improved this sealant to increase its water and fuel resistance. Samples of the new sealant were supplied to ML for testing and a final report was submitted.

**TASK ORDER 018 – Technical Analyses**

**START:** 7 Sep 95

**END:** 31 Jul 99

**FUNDING:** \$971,924

**EXPENDITURES:** \$892,725

**NUMBER OF SUBTASKS:** 26

**OBJECTIVE:** To provide both experimental and theoretical technical analyses of current materials and processes to develop and support all AF systems.

**LARGEST SUBTASKS:**

- a. 018-2 Failure Analysis – UTC, \$166,551
- b. 018-7 Surface and Cross-Sectional Analysis of A/C Materials– UTC, \$146,094
- c. 018-8 Bird Impact Testing of Radome – UDRI, \$76,652
- d. 018-1 Structural Failure Analysis – Paul Ret, \$72,069

**SUMMARY:** This task order supported much of the experimental work of the contract in materials research, particularly failure analysis. Major accomplishments under Task Order 18 include failure analyses performed (TO 018-02) on a worn airseal from an F100-PW-220 engine, some engine materials tested for corrosion when exposed to JP8 fuel additives, sermatel coated iron alloy, an HH-60G helicopter rescue hoist, Aerex 350 alloy fasteners, safe and arming block failure on an AGM-142B, and an inflight failure of a Piper aircraft. Task Order 018-07 accomplished surface and cross-sectional analyses of engine bearing assemblies and metals exposed to JP8+100 fuel, as well as analyses of metals associated with an F-16 and B1-B mishap investigation. Task Order 018-01 conducted further failure analysis tests on such items as CH-47D Bevel Gear, F-16 nose landing gear, HH-65A tailpipe failure, F100-PW-229 compressor disk lug, J85-5 compressor disks, and a B-52 tow bar.

**TASK ORDER 019 – Assessments**

**START:** 21 Nov 95

**END:** 20 Nov 97

**FUNDING:** \$1,100,183

**EXPENDITURES:** \$806,314

**NUMBER OF SUBTASKS:** 21

**OBJECTIVE:** To provide assessments of on-going and projected technical programs and technology areas as a baseline to strengthen the guiding of ML investment strategy and policy, and to study policy for current and projected AF weapons systems.

**LARGEST SUBTASKS:**

- a. 019-07 Technology Panel for Advanced Materials Support – MRI, \$135,561
- b. 019-17 High Temperature Materials Support – UTC, \$87,004
- c. 019-01 Assessment of Airbreathing and Rocket Propulsion – UTC, \$79,992
- d. 019-03 Pollution Prevention – Kolek, \$66,141
- e. 019-12 Discontinuous Reinforced Metal Matrix Composites –  
Hjelm/Wawner, \$65,064

**SUMMARY:** This task order was the second of three supporting technical assessments of ML programs. The individual subtasks typically provided ongoing support to ML program areas such as those listed above for the five largest subtasks. Individual subtask monthly/final reports were typically the documentation of this ongoing support.

**TASK ORDER 020-- Program Management**

**START:** 28 Aug 95

**END:** 31 Jan 97

**FUNDING:** \$129,234

**EXPENDITURES:** \$54,212

**NUMBER OF SUBTASKS:** 1

**OBJECTIVE:** To provide for those program activities necessary to establish task orders and conduct program management and administration over the entire program.

**LARGEST SUBTASKS:** Not Applicable

**SUMMARY:** This task order supported the UTC program management and administrative costs for the entire contract throughout the period.

**TASK ORDER 021– ML Technology Transition and Transfer**

**START:** 21 Nov 95

**END:** 20 Nov 97

**FUNDING:** \$1,514,643

**EXPENDITURES:** \$1,279,073

**NUMBER OF SUBTASKS:** 67

**OBJECTIVE:** To provide a vehicle for ML developed technologies to be recognized, accepted and transitioned to DoD contractors and transferred to the commercial sector.

**LARGEST SUBTASKS:**

- a. 021-55 CCS Process Workshops – Detterman & Assoc., \$301,666
- b. 021-02 Technology Transfer & CRDA Support – Hjelm, \$151,891
- c. 021-11 WL/ML Training – Detterman & Assoc., \$116,873
- d. 021-32 97 Aging Aircraft Meeting – UTC, \$70,414
- e. 021-20 Action Plan Development & Implementation for the F-16 SPO – Detterman & Assoc., \$50,687

**SUMMARY:** This task order is the second of three on the contract supporting the transition of a variety of technologies to the next higher stage of development. Task Order 021-02 dealt with identification of Cooperative Research and Development Agreements (CRADA) industry partners for ML developed technology with potential for dual use application. Task Order 021-32 provided for the conduct of the First Joint DoD/FAA/NASA Conference on Aging Aircraft in July 1997 in Ogden, Utah. In addition, Task Order 021-55 provided consultation to directorate supervisors regarding the Air Force Laboratory Demonstration Project. Task Order 021-11 provided organizational development and training needs to the ML Executive group, Total Quality teams and other groups in ML.

**TASK ORDER 022 – Technical Consultations**

**START:** 7 Sep 95

**END:** 23 Aug 99

**FUNDING:** \$493,600

**EXPENDITURES:** \$658,943

**NUMBER OF SUBTASKS:** 26

**OBJECTIVE:** To provide quick response access to experts for state of the art information and scientific analyses in the execution of technology initiatives and programs.

**LARGEST SUBTASKS:**

- a. 022-20 Theoretical Research to Support the Reduction of Defects in II-VI Materials – SRI, \$205,361
- b. 022-12 Development of CsGeCl and CsGeBr as Periodically Poled IR Source Materials – Rockwell Science Center, \$107,664
- c. 022-13 Theoretical Research to Support the Reduction of Defects in II-VI Materials – SRI, \$104,635
- d. 022-15 Mesophase Pitch Nanofibers – University of Akron, \$33,480

**SUMMARY:** The major portion of this task order (subtasks 022-20 and 022-13) funded consultations by Stanford Research Institute (SRI) to MLPO dealing with molecular beam epitaxial (MBE) growth of HgCdTe materials. This work resulted in numerous papers being published and presented at conferences by SRI on this topic. The work under Task Order 022-12 resulted in an improved synthesis of CsGeCl and CsGeBr larger sized crystals with improved optical quality. The task also delivered four CsGeCl and three CsGeBr crystal plates to MLPO for laser damage testing.



**TASK ORDER 024 – CAAS Sustaining Engineering**

**START:** 1 Mar 96

**END:** 23 Aug 99

**FUNDING:** \$528,488

**EXPENDITURES:** \$521,572

**NUMBER OF SUBTASKS:** 12

**OBJECTIVE:** To provide assistance in executing ML's operational and maintenance mission activities in the area of Materials and Processes for Sustainability.

**LARGEST SUBTASKS:**

- a. 024-05 Welding Specification and Specification Conversion – Bosworth, UTC, et al, \$164,408
- b. 024-06 Industry & Government Standards – Mission Systems, Inc., \$79,471
- c. 024-01 Welding Specs – T.J. Bosworth Inc., et al, \$58,980
- d. 024-11 1998 AF Wide NDI Working Group Meeting – UTC, \$34,808

**SUMMARY:** This was the only task order on the contract established to accommodate 3400 funding in performing Operations & Maintenance related technology consultations and assessments. Most activity in this task order involved consultations regarding specifications and standards conversions.

**TASK ORDER 025 – Strategic Planning**

**START:** 18 Apr 96

**END:** 31 Dec 97

**FUNDING:** \$293,670

**EXPENDITURES:** \$203,869

**NUMBER OF SUBTASKS:** 3

**OBJECTIVE:** To assess DoD, industry and academia materials R&D programs and identify technology areas requiring increased Materials Directorate emphasis, in planning for strengthening ML's continuing leadership role in materials R&D programs..

**LARGEST SUBTASKS:**

- a. 025-01 JDL Planning – UTC, \$117,393
- b. 025-03 Strategic Planning for AFRL – Ditzler, Gallagher & Associates, UTC, \$59,396
- c. 025-02 Personnel Management Study – Sexton, \$28,216

**SUMMARY:** This task order was the second of three on the contract dealing with strategic planning. Task Order 025-01 provided assistance to ML in activities associated with Project RELIANCE including preparation of the Defense Technology Area Plan (DTAP) and the Defense Technology Objectives (DTOs), Technology Area Review and Assessment (TARA) briefings, along with associated DDR&E-led coordination meetings. This also included organizing an Investment Strategy Workshop at ML. Task Order 025-03 supported the AFRL restructuring effort and development of the AFRL corporate business and strategy structure. Task Order 025-02 studied personnel management practices and developed a strategic plan for the Personnel Demo System proposed for Wright Lab S&Es.

**TASK ORDER 026– Program Management**

**START:** 1 Feb 97

**END:** 23 Aug 99

**FUNDING:** \$213,537

**EXPENDITURES:** \$121,078

**NUMBER OF SUBTASKS:** 2

**OBJECTIVE:** To provide for those program activities necessary to establish task orders and conduct program management and administration over the entire program.

**LARGEST SUBTASKS:**

a. 026-00 Administrative Program Management – UTC, \$118,779

**SUMMARY:** This task order supported the UTC program management and administrative costs for the entire contract throughout the period.

**TASK ORDER 027 – Strategic Planning**

**START:** 22 Jul 97

**END:** 23 Aug 99

**FUNDING:** \$855,250

**EXPENDITURES:** \$877,837

**NUMBER OF SUBTASKS:** 8

**OBJECTIVE:** To assess DoD, industry and academia materials R&D programs and identify technology areas requiring increased Materials Directorate emphasis, in planning for strengthening ML's continuing leadership role in materials R&D programs..

**LARGEST SUBTASKS:**

- a. 027-01 Support for Defense Reliance V and DTAP Chair for M/P – UTC, \$223,339
- b. 027-08 VS Strategic Planning – UTC, \$182,002
- c. 027-07 "I-Think" Modeling Support for Investment Planning – Sweeney & Assoc., \$142,899
- d. 027-02 Strategic Planning for AFRL – UTC, \$83,264

**SUMMARY:** This task order was the last of three strategic planning efforts on the contract. It continued the support to ML for the Project RELIANCE activities mentioned under the Task Order 025 summary. Task Order 027-08 supported numerous strategic planning efforts, meetings, workshops, and off-sites at AFRL/VS and provided technical advice to the Director and senior managers at the Directorate. Task Order 027-07 developed a computer simulation model to aid managers in technology investment resource allocation based on a return-on-investment analysis of technologies relative to the operators warfare campaign model. Task Order 027-02 assisted AFRL in the development and implementation of a new AFRL Corporate Development Program consisting of the AFRL Corporate Development Strategic Plan, development of the AFRL Organizational Development program, and implementation of the AFRL Lab Demo program.

**TASK ORDER 029 – Assessments**

**START:** 22 Jul 97

**END:** 23 Aug 99

**FUNDING:** \$1,686,044

**EXPENDITURES:** \$2,157,624

**NUMBER OF SUBTASKS:** 25

**OBJECTIVE:** To provide assessments of on-going and projected technical programs and technology areas as a baseline to strengthen the guiding of ML investment strategy and policy, and to study policy for current and projected AF weapons systems.

**LARGEST SUBTASKS:**

- a. 029-23 Defense Technology for Materials/Processes – MRI, \$291,103
- b. 029-14 WL/XP Aging Aircraft Support – UTC, \$278,453
- c. 029-03 DTAP Support – MRI, \$205,819
- d. 029-17 Propulsion Material Assessments – UTC, \$164,993
- e. 029-09 Engineering Analyses/Assessments of Aging Aerospace Systems Problems – MacLean, RNH Associates, UTC, \$147,023

**SUMMARY:** This task order was the third of three supporting technical assessments of ML programs. The individual subtasks typically provided ongoing support to ML program areas such as those listed above for the five largest subtasks. Individual subtask monthly/final reports were typically the documentation of this ongoing support. Task Orders 029-23 and 029-03 provided the Washington D. C. support to the DDR&E S&T working groups on Materials and Processes including managing and hosting the meetings and providing all administrative support. They also provided support to the TARA Chair, orchestrated the RELIANCE documentation activities (DTOs, and DTAP), and developed a history of materials research and development in the DoD. Task Order 029-14 provided on-site technical support to the AFRL Aging Aircraft office. Activities included developing briefings, planning interagency workshops, developing a technology oriented Con-ops for dealing with aging aircraft, and developing strategies to program for aging aircraft. Task Order 029-17 provided detailed assessments of the integration of IHPTET related R&D being accomplished on turbine engine components. It also provided for specific assessments of turbine engine issue areas such as Phase III materials requirements.

**TASK ORDER 030– ML Technology Transition and Transfer**

**START:** 20 Nov 97

**END:** 23 Aug 99

**FUNDING:** \$2,146,548

**EXPENDITURES:** \$2,479,886

**NUMBER OF SUBTASKS:** 42

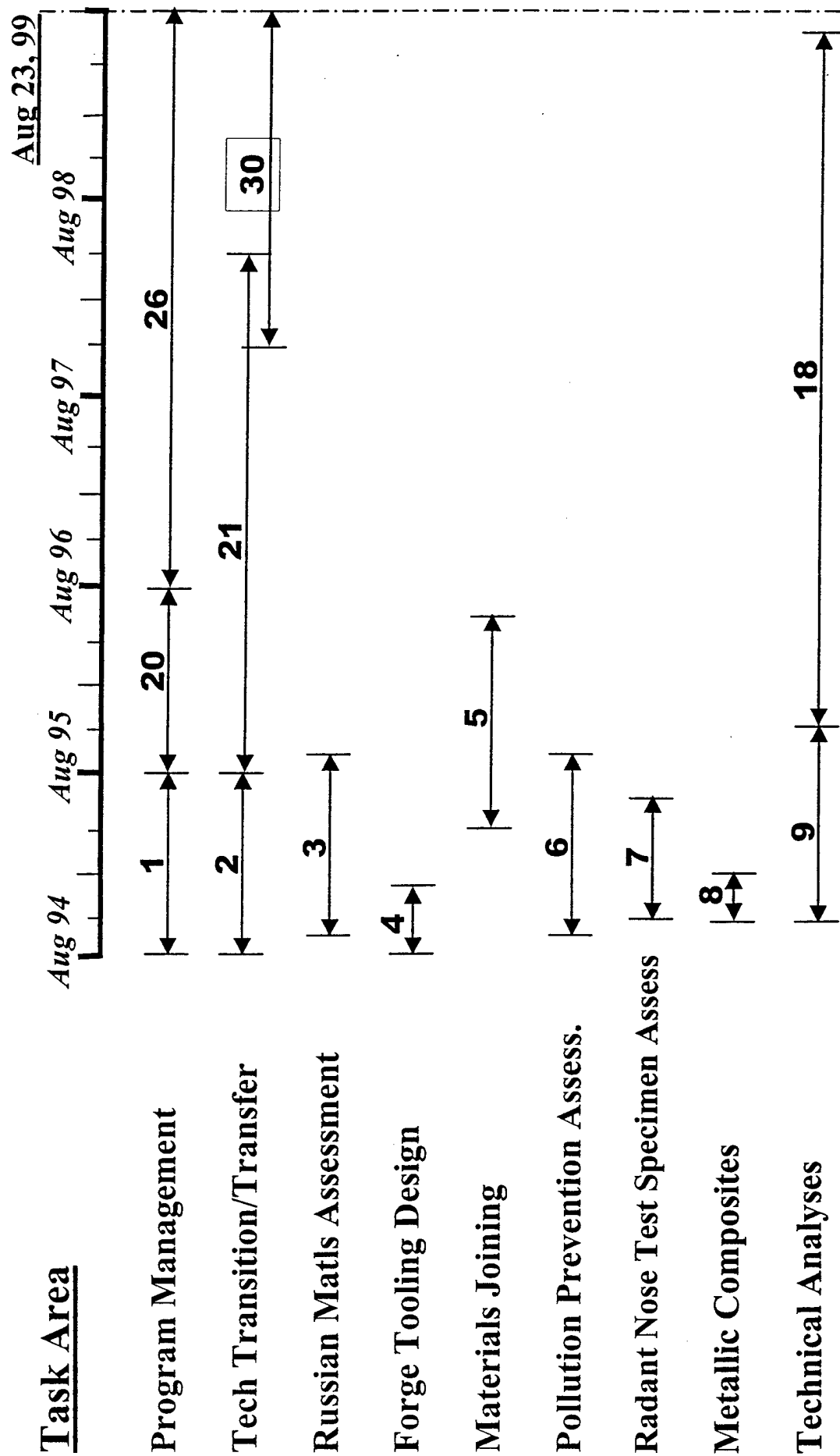
**OBJECTIVE:** To provide a vehicle for ML developed technologies to be recognized, accepted and transitioned to DoD contractors and transferred to the commercial sector.

**LARGEST SUBTASKS:**

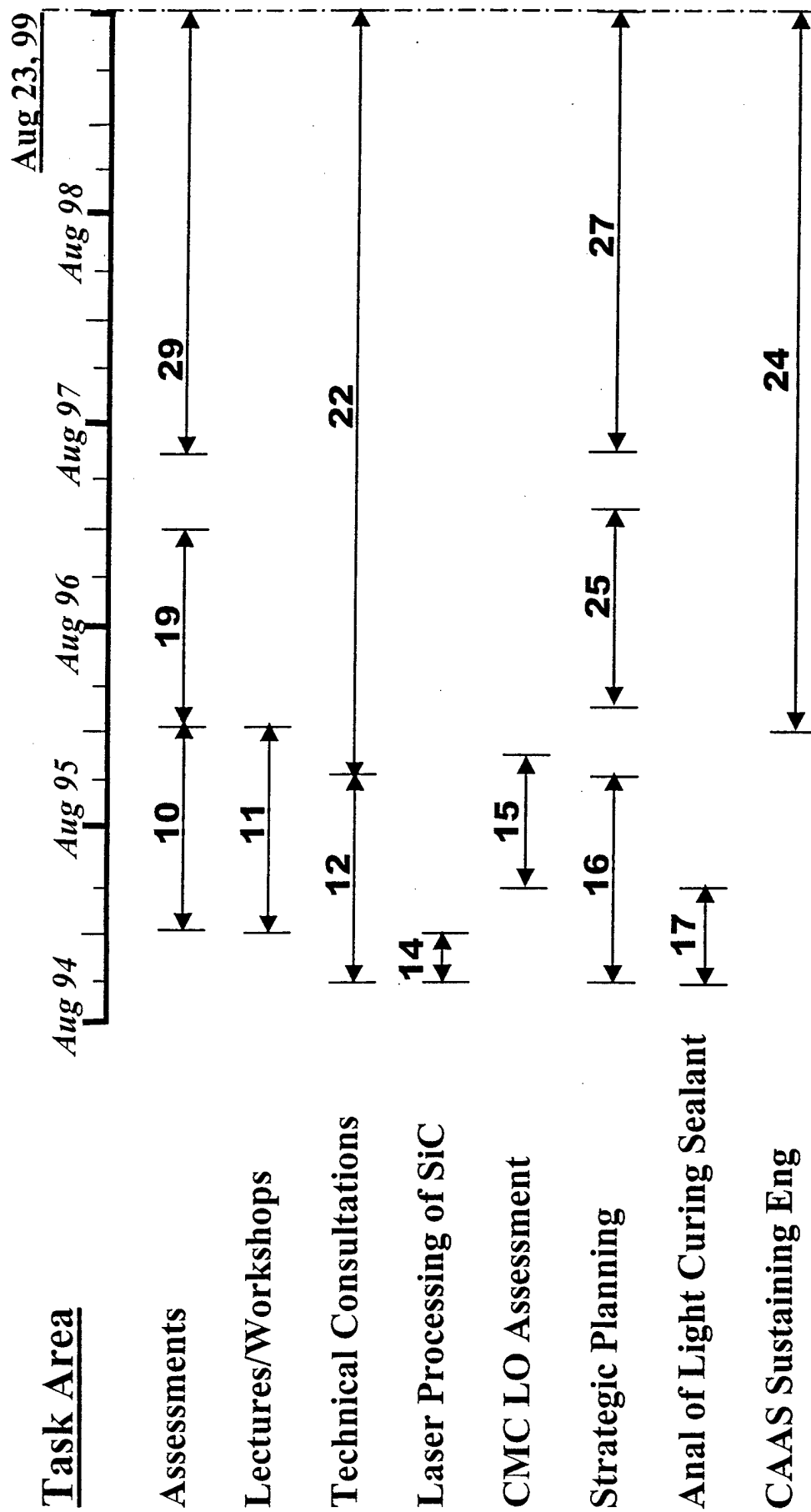
- a. 030-13 CCS Process Workshops – Detterman & Assoc., \$704,385
- b. 030-27 FY98 & FY99 SBIR Program Support – McLarty Communications, Inc., \$346,183
- c. 030-11 ICAF 1999 International Conference on Aeronautical Fatigue – UTC, \$162,470
- d. 030-01 AFRL/ML Training – Detterman & Assoc., \$153,161
- e. 030-03 Technology Transfer and CRDA Support – UTC/Hjelm, \$124,973

**SUMMARY:** This task order is the third of three on the contract supporting the transition of a variety of technologies to the next higher stage of development. Typical deliverables under this task were management support by UTC for meetings to disseminate information of ML technology (e.g. ML/MT Roadmap Reviews, Aging Aircraft Conferences, etc), meeting facilitation by Detterman & Associates (e.g. Leadership Workshops, Corporate Development Activities), and information brochures produced by McLarty Communications, Inc. (e.g. SBIR program explanations and success stories).

## Appendix A - Time Phased Listing of Issued Task Orders



## Appendix A - Time Phased Listing of Issued Task Orders





## Appendix A - List of All Subtask Efforts

Task #	Effort Title	Performers
	Overall Contract	Contract Summary
	3600 Tasks	3600 Summary
	3400 Tasks	3400 Summary
001	Program Management	UTC - Fetsko
002	Technology Transition and Transfer	Generic Task
002-01	General Support for Technology Transition and Transfer	UTC- Mantia
002-02	XPI International Plans Brochure	UTC - Fetsko
002-03	Technology Transition and Transfer (CRDA) Support	UTC - Bidwell
002-04	Advanced Processing (Casting) Support	UTC - Lombard
002-06	1995 WL Product Technology Plan & HQ AFMC/ST Data Call	UTC - Forney
002-07	Compressor Research Facility Data Acquisition and Presentation Aids	L.W. Milby
002-08	Technology Transfer of WL/ML Historical M&P Information	UTC - Bernie Chasman
002-09	Technology Transition Plan Development	UTC - Don Forney
002-10	Strategic Technical Planning	UTC & Senior Consultants

## Appendix I List of All Subtask Efforts

Task #	Effort Title	Performers
003	Russian Materials Assessment Team	Clay Harmsworth
004	Forge Tooling Design	Charlie P. Gure
005	Materials Joining for Aerospace Applications	EWI
006	Assessment to Identify Alternative Materials and Substances to Prevent Pollution	UTC - Chuck Alford
007	Assessment of Radant Nose Radome Test Specimens	UDRI
008	Metallic Composites II	Mr. Michael Foster
009	Technical Analyses	Generic Task
009-01	III-Nitride/SiC Interfaces	Northwestern University
009-03	Environmental Compatibility Study of Deicing/Anti-Icing Fluids	University of Pennsylvania
009-04	Structural Failure Analysis	UTC - Russ Henderson
009-05	Correlation of Crystallographic Texture with Fatigue Resistance in Ti Alloy Blades	General Electric Company
009-06	Mechanical Property Evaluation of CT-II Radome	University of Dayton
009-06M	Mechanical Property Evaluation of CT-II Radome	University of Dayton
009-07	Prequalified Weld Joints for Aircraft Welder Qualification	Hobart Welding & Manufacturing

## Appendix I    List of All Subtask Efforts

Task #	Effort Title	Performers
010	Assessments	Generic Task
010-01	Military Critical Technologies List (MCTL) Support	UTC - Bidwell
010-02	MCTL & DTSA Support	UTC - Sieron
010-03	Airframe & Propulsion Structural Materials Program Assessment	UTC - Bethel
010-04	Excimer Laser Update - WL/MLPO	Lewis Research & Engineering
010-05	Assessment of Advanced Materials & Technologies for IHP/TET Applications	UTC - J. Henderson, H. Bethel
010-06	Technical Assessment of System Payoff for Future IHP/TET Turbine Engine Materials and Related Technologies	Ray Fredette
010-07	Analysis of High Speed Propulsion Systems	Dean Petters & UTC
010-08	NDE Application Study	Dr. Wally Reimann
010-09	Assessment of HazardAir Dehumidifiers	SOLIS Technical Systems
010-10	FY96 MCTL	UTC - Bidwell, Sieron
011	Lectures, Workshops and Seminars	Generic
011-01	MBE Growth and Characterization Briefing	University of Illinois
011-02	Ab Initio Rate Calculations	North Dakota State Univ.

## Appendix E List of All Subtask Efforts

Task #	Effort Title	Performers
011-03	Chemical Reactions Involving Multidimensional Tunneling	Brookhaven National Lab
011-04	Morphology of Liquid Crystalline Polymers -MLBP	University of Illinois @ Urbana - Champaign
011-05	AF Corrosion Prevention Conference	UTC- Bidwell
011-06	High Temple Workshop XV 1995	UDRI
011-07	Inherently Conductive Polymers - MLB	Dr. Matt Aldissi
011-08	1995 Tri-Service Titanium Contract Review	UTC-Meenach
011-09	Coatings Workshop	Ford Motor Company, Prof Bierwagen & UTC - Johnson, Sieron
011-10	New Synthetic Strategies for Electrically Conductive Polymers - MLB	Carnegie-Mellon University
011-11	Electro-Optic Organic Films	Princeton University
011-12	Coping with Downsizing-Related Stress	The Educators Network, Inc.
011-13	1995 Combined ML/MT Roadmap Review	UTC - Fetsko
011-14	95 Air Force Aging Aircraft Program Review	UTC - Fetsko, Geidner
011-15	Structural Integrity Program Conference 1995 (ASIP December 95)	UTC - Jennewine
011-16	Strategic Planning Off-site for Executive Group	UTC - Geidner

## Appendix I List of All Subtask Efforts

Task #	Effort Title	Performers
011-17	Solvent Substitution Workshop	Weapons Complex Monitor Forums
011-18	New Electrically Conductive Polymers - MLB	Professor Reynolds
011-19	Scramjet Combustor Workshop	UTRC, Henry Lopez, U of Washington, GE, GASL, Rocketdyne, Dr. Stull, P&W
011-20	Effective Meetings	High Quality Decisions
011-21	'95 AGARD Panel Meeting	UTC - Geidner, Fetsko, Bethel
011-22	WL/XR Millennium Meeting	UTC - Jennewine
011-23	MLPJ Conference	UTC - Mantia
011-24	AFOSR Logistics Conference	UTC - Mantia
011-25	Effects of Aging on Organic Matrix Composites	Prof. Nicolais
011-26	WL/ML Bergamo Offsite	UTC - Fetsko, Geidner
011-27	WL/ML Bergamo Offsite	UTC - Fetsko, Geidner
012	Technical Consultations	Generic Task
012-01	Breakdown of Lamellar Microstructure in Titanium Alloys - WL/ML	Wright State University
012-02	Consultation on Opportunities for Advanced Materials and Processes	Purdue University

## Appendix I List of All Subtask Efforts

Task #	Effort Title	Performers
012-03	High Speed Airbreathing Propulsion Systems	Lou Carriero, John Leingang.
012-04	Temperature Stability of Magnets	Crucible Research
012-05	Pollution Prevention	Joe Kolek
012-06	Computed Core Structures in TiAl	J. Simmons
012-07	Thermal Barrier Coatings for Gas Turbine Engines	Maurice Gell
013	Microstructural Characterization of Ti-62222S - WL/MLLM	Ohio State University
014	Laser Processing of SiC	Arizona State University
015	Ceramic Matrix Composites (CMC) in Low Observable Assessment	Dr. Bob Ruh
016	Strategic Planning	Generic Task
016-01	JDL / TPAM Planning	UTC - Warren Johnson
017	Analyze and Conduct Technology Transition of Light Curing Sealant	Sunrez Corp.
018	Technical Analyses	Generic Task
018-01	Structural Failure Analysis	Paul Ret
018-02	Structural Failure Analysis	UTC - Russ Henderson

## Appendix L List of All Subtask Efforts

Task #	Effort Title	Performers
018-03	Electro-Optic Polymers - MLB	Dr. Sam Sinha
018-04	Welding Evaluation of an Al-Li Alloy	EWI
018-05	Nonlinear Optical Materials	Taitech
018-06	Core Loss Measurements	KJS Associates
018-07	Surface and Cross-Sectional Analysis of Aircraft Materials	UTC - Joe Leone
018-08	Simulated Bird Impact testing of Combat Talon II Nose Radome	UDRI
018-09	Growth of Antimonide Based Quantum Wells	Northwestern University
018-10	Completion of Mechanical Property Evaluation of CT-II Radome	University of Dayton
018-11	F-22 Inclusion Casting	EWI
018-12	Silicon Carbide Device Processing Using Ion Implantation	General Electric CRD
018-13	Al-Li Characterization and Testing	Alcoa
018-14	Electrophoretic Deposition (EPD)	McMaster University
018-15	Electrical Characterization of Wide Bandgap Semiconductors	University of Cincinnati
018-16	Neutron Diffraction Analyses	Los Alamos National Laboratory

## Appendix E List of All Subtask Efforts

Task #	Effort Title	Performers
018-17	Electron Microscopy Studies of Orthorhombic-based Titanium Aluminides	Rockwell Science Center
018-18	Microstructural Details of SiC Fibers	University of Virginia
018-19	Development of Sol-Gel Thin Films and Coatings	None - Canceled
018-20	Physics of Failure of Aerospace Coatings- MLB	Battelle
018-21	Anti-Reflection Coating on Zinc Germanium Phosphide	II-VI Inc.
018-22	X-ray Equipment at NSLS	SUNY at Stony Brook
018-23	Core Loss of Coated FeCo Laminates - AFRL/ML	KJS Associates
018-24	Analytical Electron Microscopy of Orthorhombic Titanium Aluminides	Rockwell Science Center
018-25	Oxidation for Generation Laminates	UDRI
018-26	Microstructure of Spin-Cast Aluminum Alloys	Dr. A. K. Ghosh - Applied Materials Research -(U of Michigan)
019	Assessments	Generic Task
019-01	High Temperature Materials Support	UTC - Bethel
019-02	MCTL Support	Gordon Griffith
019-03	Pollution Prevention	Joe Kolek



## Appendix L List of All Subtask Efforts

Task #	Effort Title	Performers
019-04	Ceramic Matrix Composites (CMC) in Low Observable Assessment	Dr. Bob Ruh
019-05	Propulsion Assessments	UTC - Beecroft
019-06	Specification Conversion	UTC - Cooper
019-07	DTAP Support	MRI - Management Resources Inc.
019-08	Electronic & Optical Materials Studies and Assessments	UDRI
019-09	Electrical Conductivity Measurements	Max Alexander
019-10	MCTL 97 and DTSA	Gordon Griffith & UTC - Bidwell/Sieron
019-11	Pollution Prevention	Joe Kolek
019-12	Discontinuous Reinforced Composites	Larry Hjelm
019-13	NASA Lewis Effort	UTC - Bob Henderson
019-14	Phillips Laboratory Technical Support and Interface	ATAPA
019-15	Engineering Analyses/Assessments of Aging Aerospace Systems Problems	RNH Associates & UTC
019-16	F117-PW-100 Engine Maintenance Cost Study	LOGTECH
019-17	High Temperature Materials Support	L. Hjelm, William Schimmel & UTC - J. Henderson, A. Gunderson

## Appendix L List of All Subtask Efforts

Task #	Effort Title	Performers
019-18	Organic Coatings Support & Training	F.D. Kisor
019-19	Assessment of DARPA Contracts	UTC - Neff
019-20	1996 USAF Propulsion Center of Excellence	UTC - Grimm
019-21	WL/XP Aging Aircraft Support	UTC - Dr. Minges
020	Program Management	Generic Task
021	Technology Transfer & Transition	Generic Task
021-01	96 Air Force Corrosion Conference	UTC - Jennewine
021-02	Technology Transfer and CRDA Support	Larry Hjelm
021-03	SAMPE Support	UTC - Cooper
021-04	Technology Transition Plan Development	UTC - Forney
021-05	HQ AFMC/ST Database Support	UTC - Fetsko
021-06	WL/ML Historical M&P Information	UTC - Chasman
021-07	Laser Hardened Materials & DEW Program Review	UTC - Kilian
021-08	Structural Integrity Conference (ASIP Proceedings)	UTC - Jennewine

## Appendix E List of All Subtask Efforts

Task #	Effort Title	Performers
021-09	Central Regional ACS Meeting	Clark Atlanta Univ, Cornell Univ, Univ of Ill.
021-10	Aging Aircraft Program Review (Proceedings)	UTC - Kilian
021-11	WL/ML Training	Detterman & Assoc.
021-12	AFOSR Logistics Conference	UTC - Kilian
021-13	1996 Combined Roadmap Review	UTC - Meenach
021-14	Central Regional ACS Meeting	Univ of Toronto
021-15	Thermal Conductivity Testing Seminar	Ray Taylor
021-16	WUD 55 Seminar	Rutgers University
021-17	ASIP 96	UTC - Jennewine
021-18	1997 Tri-Service Titanium Review - MLL	UTC - Jennewine
021-19	Modern Millennium Follow-up	None - Canceled
021-20	Action Plan Development and Implementation for the F-16 SPO	Detterman & Assoc
021-21	96 Aging Aircraft Meeting	UTC - Kilian
021-22	HAVE Forum 97	UTC - Kilian

## Appendix E List of All Subtask Efforts

Task #	Effort Title	Performers
021-23	Aeromat Registration	UTC - Fetsko
021-24	Lehigh Microscopy Course	Debbie Williams
021-25	YAE Fiber Review	UCLA
021-26	Epitaxy of Lattice-Mismatched III-V Semiconductors	Joran Roslund
021-27	Quantum Wells for Infrared Detection	Institute for Microstructural Sciences
021-28	Fall Polymer Workshop	University of Illinois
021-29	Characterization of Polymer Films	Case Western Reserve University
021-30	Coping with Downsizing-Related Stress	The Educators Network, Inc.
021-31	Nanoscopic Surface Preparation of GaAs	Penn State University
021-32	97 Aging Aircraft Meeting	UTC - Kilian
021-34	97 ML & MT Combined Roadmap Review	UTC - Meenach
021-35	Vision 21	UTC - Jennewine
021-36	Relaxations of Polymers in Blends -WL/MLB	University of Houston
021-37	WL/ML Microfilm Drawings	A.M. Kinney

## Appendix E List of All Subtask Efforts

Task #	Effort Title	Performers
021-38	CFIPT Support	UTC - Cooper, Cochoy, M. Beach, T. Boone
021-39	Public Relations and Communications Support - (AFOSR)	McLarty Communications, Inc.
021-40	Polymer Workshop	Carnegie-Mellon University
021-41	Work Related Stress Seminars	Dr. Stephen Frederick
021-42	Air Force Aircraft/Runway Deicing Workshop	UTC - Cooper
021-43	Executive Group Offsite	UTC - Jennewine
021-44	Information Dissemination	Reva Caudill, Reta Boggs, Sallie Ferguson
021-45	1997 Structural Integrity Conference (ASIP)	UTC - Jennewine
021-46	MLL Seminars	Professor Srolovitz, Dr. Chen, Juan Sanchez, Professor Olson
021-47	1997 Workshop on the Chemistry & Physics of II-VI Materials	Pallisades Institute for Research Services
021-48	Photovoltaic Applications	Matt Aldissi
021-49	Materials Directorate Workshops	UTC - Barthelemy
021-50	Training Systems Product Group (TSPG)	UTC - Barthelemy
021-51	ICAF Planning	UTC - Jennewine

## Appendix L - List of All Subtask Efforts

Task #	Effort Title	Performers
021-52	Phillips Lab Training	UTC - Barthelemy
021-53	WL/ML Executive Group Offsite	UTC - Jennewine
021-54	Polymer Electronics: Light Emitting Diodes Workshop	Dr. Daniel Roitman, Professor Forrest, Professor Epstein
021-55	CCS Process Workshops	Detterman Associates Gallagher & Assoc
021-56	Workgroup Offsite	UTC - Jill Jennewine
021-57	AI MMC Workshop	Dr. Carl Zweben & UTC - Jennewine
021-58	Small Business Administration (SBA) Support	McLarty Communications, Inc.
021-59	High Temperature Materials Workshop	Professor Sun, Professor Perepezko
021-60	NASP Lessons Learned Workshop	Howard Nelson, William Kerr, & UTC - Ted Norbut, J. Jennewine, L. Hjelm
021-61	Fall Polymer Workshop	Dr. Stegman, Dr. Van Stryland
021-63	WL/ML Executive Work Group	UTC - Jennewine
021-64	Second Connector Bonding Workshop	None - Canceled
021-66	Materials and Mantech Series	Canceled - None
021-67	Customer Needs Workshop	UTC - Geidner

## Appendix L - List of All Subtask Efforts

Task #	Effort Title	Performers
022	Technical Consultations	Generic Task
022-01	WL/ML Training	Detterman Assoc.
022-02	Seminar on High Temperature Composite Materials	Dr. Lon J. Mathias
022-03	Seminar on Deep Level Luminescence Spectroscopy	Dr. Brillson
022-04	MLB Seminar	Dr. Susan Ermer
022-05	WL/ML Training and Consultation	Detterman & Associates
022-06	IR Detector Research	Dr. Paul Thibado
022-07	Wide Bandgap Semiconductor Transistor Microwave Amplifiers	CWRU
022-08	Epitaxial Growth of III-V Nitride Wide Bandgap Semiconductors	Northwestern University
022-09	High-Field Investigations on SiC Structures	University of South Carolina
022-10	Use of Cleanroom for Deposition of Polymer Films - MLBP	Ohio State University
022-11	Dynamic Magnetic Compaction (DMC) of Rare Earth Cobalt Powders	IAP Research
022-12	Development of CsGeCl and CsGeBr as Periodically Poled IR Source Materials	Rockwell Science Center
022-13	Theoretical Research to Support the Reduction of Defects in II-VI Materials - MLOP	SRI

## Appendix L List of All Subtask Efforts

Task #	Effort Title	Performers
022-14	Crystallographic Texture Analysis of Ti-22Al-23Nb Sheet Materials	Carnegie-Mellon Univ -Anthony Rollett
022-15	Mesophase Pitch Nanofibers	University of Akron
022-16	IR Windows	None - Canceled
022-17	Design of Silicon Carbide Devices for Materials Evaluation	Dale Brown
022-18	Compliant Universal Semiconductor Substrates	Cornell University-Prof Lo
022-19	WUD 54 Reviews	Billelo, Yalisove, Bement, Richmond, Chandra, Lockheed Martin-Dean & UTC
022-20	Theoretical Research to Support the Reduction of Defects in II-VI Materials	SRI
022-21	Electrophoretic Deposition	McMaster University-Admena
022-22	F-22 Technical Support	T.J. Bosworth Inc
022-23	Literature Review on Orthorhombic Titanium Aluminide Composites	Rockwell Science Center
022-24	MLPO Technical Discussions/Seminar	Dr. Ikai Lo
022-25	Nano Composite Project	Jannis Brown
022-26	Mil-Hdbk-5 Meeting	Tom Bosworth
023	Sustainment	None - Canceled



## Appendix L - List of All Subtask Efforts

Task #	Effort Title	Performers
024	CAAS Sustainment	Generic Task
024-01	Welding Specs	T.J. Bosworth Inc.; Philip A House
024-02	NDI Working Group Meeting	UTC - Tapia
024-03	Air Force 96 Corrosion Conference	UTC - Jennewine
024-04	Tech Order 33B-1-1 Revision	UTC - Noel Tracy
024-05	Welding Specification and Specification Conversions	Tom Reed, McDonnell Douglas, T.J. Bosworth Inc. & UTC - Cooper
024-06	Industry & Government Standards	Mission Systems, Inc
024-07	1997 AF Wide NDI Working Group Meeting	UTC - Fetsko, Geidner
024-08	Support for Fuels and Lubrication Performance Specifications	UTC - Cooper
024-09	Runway De-icing Support	UTC - Cooper
024-10	AGM-142 Saddle Weld	UTC - Noel Tracy
024-11	1998 AF Wide NDI Working Group Meeting	UTC - Tracy Tapia
024-12	Information Dissemination	Reta Boggs, Sallie Ferguson
025	Strategic Planning	Generic Task

## Appendix E List of All Subtask Efforts

Task #	Effort Title	Performers
025-01	JDL Planning	UTC - W. Johnson
025-02	Personnel Management Study	Charles Sexton
025-03	Strategic Planning for Air Force Research Laboratory	Tim Ditzler, Dennis Gallagher & Associates & UTC - Barthelemy
026	Program Management	UTC - Cochoy , Turner
026-00	Administrative Program Management	UTC - Cochoy , Turner
026-01	Financial Program Management	UTC - Cochoy , Turner
027	Strategic Planning	Generic Task
027-01	Support for Defense Reliance V and DTAP Chair for M/P	UTC - W. Johnson
027-02	Strategic Planning for Air Force Research Laboratory	UTC - Barthelemy
027-03	Advanced Materials Technology Support	Jim Condon
027-04	EN Strategic Planning Support ASC/EN	UTC - Jim Mattice
027-05	Advanced Technology Concepts Study	John Griffin, Ball Aero-Ray Haas, UTC - J. Mattice & K. Richey
027-06	Strategic Alternatives for AFRL	Fred Diamond & UTC - Jim Mattice, Keith Richey, Bill Byrne
027-07	"I-Think" Modeling Support for Investment Planning	Dr. Patrick J. Sweeney

## Appendix E - List of All Subtask Efforts

Task #	Effort Title	Performers
027-08	VS Strategic Planning	UTC - Bill Byrne, Gary Dubro
028	Technical Analyses	Not Awarded
029	Assessments	Generic Task
029-01	MCTL 97 and DTSA	UTC - Bidwell, Sieron, Griffith
029-02	Ceramic Matrix Composites (CMC) in Low Observable Assessment	Dr. Bob Ruh
029-03	DTAP Support	MRI - Management Resources Inc.
029-04	Electronic & Optical Materials Studies and Assessments	UDRI - Edward Kuhl
029-05	Pollution Prevention	Joe Kolek
029-06	Discontinuous Reinforced Composites	UTC - J. Henderson, L. Hjelm
029-07	NASA Lewis Effort	Pegasus Engineering Serv. & UTC - Bob Henderson
029-08	Phillips Laboratory Technical Support and Interface	ATAPA
029-09	Engineering Analyses/Assessments of Aging Aerospace Systems Problems	Brian Maclean, RNH Associates & UTC - D. Forney
029-10	High Temperature Materials Support	Bill Schimmel, Ed Starke & UTC - W. Johnson, A. Gunderson
029-11	Organic Coatings Support & Training	Kushner Electroplating, F.D. Kisor

## Appendix L - List of All Subtask Efforts

Task #	Effort Title	Performers
029-12	Assessment of DARPA Contracts	UTC - Neff
029-13	1996 USAF Propulsion Center of Excellence	UTC - Grimm
029-14	WL/XP Aging Aircraft Support	UTC - Dr. Minges
029-15	Army Science & Technology Support	MRI
029-16	Physics of Coatings Failure	Battelle
029-17	Propulsion Material Assessments	UTC - B. Henderson
029-18	High Cycle Fatigue (HCF)	Peter Torvik, UTC - Jack Henderson
029-19	Space Planning and Assessments	Bill Byrne
029-20	Mil-Std Conversion	SAE
029-21	Coatings Technology Integration Office Programmatic Support	Fred Whitican, Meighan Altwies
029-22	AFOSR Metrics Study	Bill Byrne
029-23	Defense Technology for Materials/Processes	MRI - Management Resources Inc.
029-24	High Temperature Materials Support	UTC - A. Gunderson
029-25	Engineering Analyses/Assessments of Aging Aerospace Systems Problems	Dick Haddock & UTC - Cooper

## Appendix B List of All Subtask Efforts

Task #	Effort Title	Performers
030	ML Technology Transition and Transfer	Generic Task
030-01	AFRL/ML Training	Detterman & Associates & UTC - J. Jennewine
030-02	1998 Roadmap Review	UTC - Tapia
030-03	Technology Transfer and CRDA Support	UTC - Bidwell, Hjelm
030-04	1997 Tri-Service Titanium Review	UTC - Jennewine
030-05	97 Aging Aircraft Meeting Proceedings	UTC - T. Tapia, C. Burns
030-06	WL/ML Microfilm Drawings	UTC - Fetsko
030-07	Public Relations and Communications Support (AFOSR)	McLarty Communications, Inc.
030-08	Information Dissemination	Reta Boggs, Sallie Ferguson, Reva Caudill
030-09	1997 Structural Integrity Conference (ASIP)	UTC - Jennewine, Cooper, Burns
030-10	Training Systems Product Group (TSPG)	UTC - Barthelemy
030-11	ICAF 1999 - International Conference on Aeronautical Fatigue	UTC - Jennewine, Delisse
030-12	Phillips Lab Training	UTC - B. Barthelemy
030-13	CCS Process Workshops	Detterman Assoc, Gallagher Assoc. UTC- B. Wood, J. Mattice, C. Sexton

## Appendix E List of All Subtask Efforts

Task #	Effort Title	Performers
030-14	AI MMC Workshop	UTC - Tapia
030-15	Small Business Administration (SBA) Support	McLarty Communications, Inc.
030-16	AFRL/ML Executive Work Group - AIAA	UTC - Jennewine T. Cooper, D. Forney
030-17	Second Connector Bonding Workshop	UTC - Jennewine
030-18	1998 Materials and Manufacturing Technology Series	Dr. Chu, Art Fry & UTC - Tapia
030-19	Customer Needs Workshop	UTC - Jennewine
030-20	HAVE '97 Forum Proceedings	UTC - Tracy Tapia
030-21	Dual Use Bidders Conference	UTC - Geidner
030-22	CCS Sensors Directorate	Dennis Gallagher & Assoc.
030-23	CCS Air Vehicles Directorate	Strategic Leadership Ass, Gallagher, David Noer
030-24	Air Force and Aerospace Metals Industry Workshop	UTC - Tapia
030-25	Self-Assembled Polymer Films for Multifunctional Coatings	Prof. Seery, Prof. Hammond
030-26	Cross-section Scanning Tunneling Microscopy	Dr. Rachel Goldman
030-27	FY98 & FY99 SBIR Program Support	McLarty Communications, Inc.

## Appendix E List of All Subtask Efforts

<b>Task #</b>	<b>Effort Title</b>	<b>Performers</b>
030-28	1998 ASIP - Structural Integrity Conference	UTC - Jennewine, Cooper, G. Delisse
030-29	1998 Workshop on the Chemistry & Physics of II-VI Materials	Palisades Institute for Research Services - Mark Goldfarb
030-30	Information Dissemination and Functional Programs	Reva Caudill
030-31	"I-Think" Modeling Support for Investment Planning	Dr. Patrick J. Sweeney
030-32	Organizational Development - Human Effectiveness Directorate	Dr. David Noer, Detterman
030-33	AFRL/VAAC Brochure	UTC - Keith Cole, S. Blevins, M. Beach
030-34	HAVE '99 Forum - Low Observable Symposium	UTC - Tracy Tapia, G. Randall, C. Burns, B. Woods
030-35	AF SMC Manufacturing Problem Prevention - MLOP	UTC - Sieron
030-36	Dual Use Program Office Brochure	UTC - C. Burns
030-37	Strategic Planning Support	Ball Aerospace, Dr Fred Diamond, Carl Cafiero & UTC-Keith Richey, Jim Mattice
030-38	Polymer Workshop-Polymeric Materials and Films for Space Applications	John Connell, Thad Fredrickson, Roderick Tennyson
030-39	1999 Roadmap Review	UTC- T. Tapia
030-40	1999 Materials and Manufacturing Technology Series	UTC - Tracy Tapia
030-41	DoD/FAA/NASA Aging Aircraft Conference - 2000	UTC - J. Jennewine

## Appendix I · List of All Subtask Efforts

Task #	Effort Title	Performers
030-42	AFRL Research Council Offsite Planning and Support	The Cumberland Group - Mike Guibord
031	Assessments	Not Awarded